PATENT ABSTRACTS OF JAPAN

(11)Publication number : 11-055534

(43)Date of publication of application : 26.02.1999

(51)Int.Cl. H04N 1/60
B41J 2/525
B41J 2/52
G03F 3/10
H04N 1/407

(21)Application number : 09-203283

(22)Date of filing : 29.07.1997

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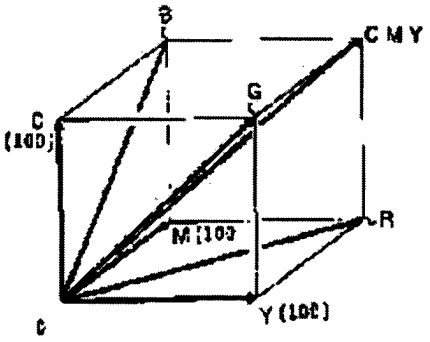
(54) COLOR CONVERSION DENSITY GRADATION COMPENSATION METHOD AND ITS COLOR PRINTER

(57)Abstract:

PROBLEM TO BE SOLVED: To prevent void in solid from occurring by using 0% about the 0% color when at least one color such as a characteristic color of C, M, Y and K and further R, G, B and GOLD, etc., is 0%.

SOLUTION: For instance, in the case of a color combination of Y, M and C, a three-dimensional look-up table is used. Matrices of the look-up table are decided through observation about whole colors in both a printed matter and a color printer. Then, for instance, even if C is 0% color, the C is closer to the target color, where the C is 1%. In such a case, a color proof is generated with a value of C=1%. Therefore, only when at least one color among C, M, Y and K is print of 0% color proof (even when hues are matched all the better because the 0% color is mixed in itself), 0% is used about the 0% color.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

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* NOTICES *

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to the printer which can do the color conversion method and the concentration gradation amendment method of the printer for mainly creating the color proof for printing which creates a color picture, and it.
[0002]
[Description of the Prior Art] When creating a color proof using the color conversion (it is henceforth called "color matching".) technology of aligning a color-print with printed matter, the same color matching technique as usual is used. That is, the method of once changing yellow (Y), a Magenta (M), cyanogen (C), and black (K) data into a chromaticity value generally, and changing it into C-M-Y-K data peculiar to a print system through a translation table again is used. This is the color matching technique which has come out to the commercial scene as "Color Sync" (tradename) and which was known well.
[0003] Moreover, the concentration calibration technology carried out to an amendment sake in the sensitivity difference of material or a machine is indicated by Japanese Patent Application No. No. 126108 [09 to] of point ** concerning the same applicant. According to the concentration calibration technology, the interval of specification network % is fixed.
[0004]
[Problem(s) to be Solved by the Invention] However, there were the respectively following problems in the two above-mentioned conventional methods. first, if color matching is applied to pure colors, such as red (R), blue (B), green (G), and Y, M, C, when creating a color proof using the color matching technology of the former conventional technology, when the hue of a coloring material has shifted from the target hue, it may happen that the highlight which is the color of slightly others is mixed with a pure color In order to check the rightness of image data, if a user does check work with a magnifier, in the case of half-tone-dot gradation (it is hard to be checked by looking in the case of concentration gradation.), the following problems will occur the color proof created in this way. That is, if the hue of a coloring material has shifted from the target hue when the conventional color matching is applied to consisting of only a Magenta (M) and yellow (Y), that cyanogen (C) is mixed can awake red (R), for example. Now, it is the problem which will have misunderstanding if the original data are wrong, since cyanogen (C) is mixed while the user is checking with the magnifier that it is data of a Magenta (M) and yellow (Y). Thus, although original former data were right, when Calah-matching was applied, it might happen that the color of slightly others is mixed with a pure color in this way.
[0005] Moreover, in the case of the 2nd conventional technology using a concentration calibration, there were the following troubles.
1) in the case of half-tone-dot gradation, unlike concentration gradation, it is solid (namely, a shadow, 100% of gradation) -- or it will be easily recognized with a magnifier whether it is 99% That is, it is the problem that will discover a white omission in some places if the user is looking with the magnifier in order to be easy to discover the white omission in solid one and to check that it is solid, have misunderstanding as the original data are wrong, and a check is not made.
2) When it is especially black, the operating frequency of the character using solid one is high, since a size also needs to be strictly right and it is [it becomes thin and] visible, when the way of the edge of a character becomes blurred, in order to lose this, 99% of gradation is inadequate, and it must become 100% of gradation certainly.
3) Even if it changes the sensitivity performance of material or a machine, you always have to solve the above-mentioned technical problem. Therefore, it is necessary to carry out concentration carry BURESHOYON which abolishes the sensitivity performance difference of material or a machine. In the case of half-tone-dot gradation, and it

did not attach whether the point of ** highlight would stick or ** solid is crushed, it has not blurred, or especially ** is important. Even if some intermediate gradation has shifted, its tolerance is higher than a highlight and a shadow. Then, the precision of a highlight and a solid concentration calibration needed to be raised.
4) The direction more than a secondary color may have the sensitivity of record material higher than a primary color. In this case, in case a concentration calibration is carried out in a primary color, the degree of margin for reproducing gradation continuously above a secondary color is the problem that a highlight side runs short of. Moreover, since the sensitivity performance changed with a material difference and machine differences, in the case of the low material and the machine of sensitivity, a shadow could not be made, and it happened that a highlight cannot be made in the case of material and a machine with high sensitivity.
5) Although it is made to improve with [of a highlight] a point by given and warming weak energy on a non-picture portion or a head from before, in a highlight, the dot has stuck also in the non-picture portion in this case above a secondary color.
this invention solves these above-mentioned technical problems, and moreover it seems that it does not give misapprehension as former data are wrong to the user, it offers the concentration gradation amendment method which does not depend a material difference, a machine difference, and more than a secondary color, but can be formed from a highlight to a shadow.
[0006]
[Means for Solving the Problem] In order to solve the technical problem of the above [0004], invention concerning this application claims 1 and 2 is characterized by using 0% about the color concerned which is 0%, when at least 1 colors, such as the special features, such as R-G-B-GOLD, are 0% at a coloring material, i.e., a C-M-Y-K pan, in the case of the color conversion of 3-dimensional one or more by color matching.
[0007] Moreover, in order to solve the technical problem of the above [0005], invention to which it presupposes only the solid gradation of a shadow that invention concerning a claim 3 is characterized by usually making an energy difference larger than gradation, and it starts a claim 4 is characterized by only K making the difference larger than other C-M-Y-K in the concentration gradation amendment method according to claim 3. Moreover, invention which invention concerning a claim 5 carries out a concentration calibration using the patch for concentration calibrations which made fine the unit before and behind a highlight and a shadow, and relates to a claim 6 is characterized by having the patch for concentration calibrations which made fine the unit before and behind a highlight and a shadow. Furthermore, invention concerning a claim 7 is characterized by taking energy margin width of face to a highlight and shadow side, and is characterized by taking the energy margin width of face larger than a shadow side by the side of a highlight in that case. And invention concerning a claim 9 is faced giving energy weak also on the head of a non-picture portion at the time of a primary color, and the strength of the energy is characterized by being the value which is the grade by which a dot is not printed by the non-picture portion at the time more than a secondary color.
[0008]
[Embodiments of the Invention] Hereafter, the concentration gradation amendment method of the printer which creates a color picture by the thermal head of this invention, and its color printer are explained in detail with reference to a drawing. First, when at least 1 color of C-M-Y-K is 0% in the case of color conversion given in the above [0006], it explains using 0% about the color concerned which is 0%. For example, in the case of the combination of the color of Y-M-C, a 3-dimensional look-up table like drawing 5 can be considered. In drawing 5 , a zero can consider the model which Y and the Y-axis called M by C, and the Z-axis called [the X-axis] 100% of cube at 0%, red (R) is on the diagonal line of Y and M, green (G) is on the diagonal line of C and Y, and blue (B) has it on the diagonal line of M and C. Moreover, it will become a sour orange, if red (R) approaches M on an Y-M side and purplish red and Y will be approached. this 3-dimensional look-up table -- every -- the time of former data called Y-M-C being given -- respectively -- Y -- the matrix of changing into '-M'-C' is contained in this 3-dimensional look-up table Furthermore, if K (black) is also added, the 4-dimensional look-up table expressed to drawing 4 can be considered. The matrix of a look-up table is decided by survey about the total color by both printed matter and the color printer. Therefore, when the 3-dimensional [or more] look-up table determined by survey is used, even if a target is a pure color, if a target pure color is printed by the color printer, there are not few cases where the direction where colors other than a pure color were mixed becomes a chromaticity value more near the pure color, in fact. For example, when the direction whose C is 1% is closer to the color of the target than the place whose C is 0% making the C0% color print by the color printer though C is 0% of color, a color proof will be made from C= 1% of value. When are done so and a user sees this color proof with a magnifier, C will be easily noticed being mixed with the place where C should not be mixed (on the other hand, even if C is contained in the place whose C should be 16%, for example 17%, a user hardly notices this difference.), and the misapprehension whether this data is mistaken will be given. Then, it is this invention to use 0% about 0% of the color concerned, (even if it is the case where a hue suits further the direction where 0% of

the color was originally mixed), only when at least 1 color of C-M-Y-K is the print of the color proof which is 0%. In a 3-dimensional example, the color whose at least 1 color of C-M-Y is 0% points out three cubical ridgeline C-M-Y, three cubical diagonal line B-R-B, the color on an Y-M side (for example, orange), the color on a M-C side (for example, purple-blue), and the color on a C-Y side (for example, yellowish green). Only when at least 1 color of such C-M-Y is a color which is 0%, suppose that it is dealt with as mentioned above.

[0009] What is necessary is just to make it what made 0% gradation of the color concerned energy fixation, when at least 1 color of C-M-Y-K in which C-M-Y or K also specifically included the translation table used in the case of a concentration calibration is 0%. If a color proof is created using the translation table carried out in this way, cannot cause a user's misapprehension and it can be carried out. If near of the hue of a pigment is carried out very much to the ink of printing, un-arranging [that a hue changes a lot] will not happen, either.

[0010] next, concentration gradation assistant ** given in the above [0007] -- just -- ******** The graph of drawing 7 (A) is the curve of a monochrome gradation reappearance target, and it is the dot percent when measuring a horizontal axis at the dot percent of a former picture, and measuring a vertical axis with a reflection density measuring instrument. Reflection density is dot percent reappearance (dot %) by MARE Davis's formula. Namely, in order to judge this with not special measurement but the concentration meter of image analysis etc., The amount of optical dot gain of a color proof is assumed to be color art [by Fuji Photo Film Co., Ltd.] CR-T3 EQC. Color art Dot percent calculated by MARE Davis's formula from the reflection density of CR-T3 are set as a reappearance target. a former picture (input digital data) -- receiving -- our paper of the output picture of a color printer -- it is making for the color proof half-tone-dot area reappearance after an imprint to be in agreement into the ideal (target)

[0011] In this invention, compression and endpoint movement of the gradation shown in the graph of drawing 7 (B) by this invention in mounting to the color printer for color proofs were given, and this was considered as the monochrome reappearance curve of a color printer so that the above-mentioned reappearance target could be attained also in all cases. That is, the graph of drawing 7 (B) is the gradation value (record energy) highest [in / a color printer engine / a horizontal axis is a gradation design, and 256 ****s is carried out from 0 from the right to the left, and / in the right], and the left is the gradation value zero in a color printer engine. The feature of this graph is becoming black solid [of the dot percent reappearance 100] in the horizontal-axis number 244, and having become the highlight of the dot percent reappearance 0 in the horizontal-axis number 39. That is, it is the feature of this invention to have set it as per [instead of 255 of a horizontal axis] 244 that the standup of a highlight of the dot percent reappearance 0 starts from per [instead of 0] 39, and reaches black solid of the dot percent reappearance 100. 0-39,244-255 of a horizontal axis are called degree of margin by this invention here.

[0012] The need for this degree of margin is explained using the graph of drawing 8 (A) which is a method by the conventional concentration calibration, and the graph of drawing 8 (B) by this invention. The ideal (target) curve of drawing 7 (A) is drawn on drawing 8 (A) as the solid line, and the dot percent curve of the ideal (target) of drawing 7 (B) is drawn on drawing 8 (B) as the solid line. a high sensitivity graph (dashed line) when material and a machine use a high sensitivity thing on the left-hand side of each ideal solid line curve of both graphs -- right-hand side -- material and a machine -- low -- the low sensitivity graph (two-dot chain line) at the time of using a sensitivity thing is drawn Dot percent are also called half-tone-dot %, and are the rate of area of the ink printed (print). If the graph of drawing 8 (A) is seen, at the time of impression energy 0%, dot reappearance % is also 0 and, as for the ideal solid line curve, dot reappearance % has also become 100 at the time of impression energy 100%. However, in the graph of drawing 8 (A), when a thing with a material difference or a machine difference is used, even if it applies the same energy, it happens to change dot percent. In a shadow and a highlight, when there is no margin in right and left, the following problems arise. For example, when it is the material and the machine whose sensitivity is too low, it becomes a two-dot chain line low sensitivity graph on the right-hand side of an ideal solid line curve. If it does so, dot reappearance % has finished near 97% at the time of impression energy 100%, without being set to 100. That is, it happens that dot percent 100% which is full gradation cannot be taken out with a shadow side. When the machine of the case where it is material with similarly high sensitivity, or high sensitivity is used, it becomes a dashed-line high sensitivity graph on the left-hand side of an ideal solid line curve. If it does so, dot percent are finished as per 3% at the time of impression energy 0%, without being set to 0. That is, it happens that it becomes impossible to take out highlight 0% shortly. Furthermore, there is an inclination for the sensitivity of material to be [the direction more than a secondary color] high (that is, for dot percent to come out mostly rather than a primary color in the secondary color even if it gives the same energy), rather than monochrome (primary color). The graph which shows the inclination is drawn by the dotted line by drawing 8 (A). Also in this case, the same inclination as the case of the material and the machine of previous high sensitivity is shown, and expression of a highlight will become impossible if it is the conventional method.

[0013] On the other hand, since the degree of margin looked at by drawing 8 (B) is made according to the amendment method of this invention, also in the case of the material and the machine of ** low sensitivity, also in the case of the

material and the machine of ** high sensitivity, dot percent can reappear to 0 - 100% also in ** color [secondary] printing.

[0014] The table is carried for the concentration calibration table which realizes the amendment method of this invention by drawing 9 - drawing 17 . This table is the thing of gradation design 256 gradation, the gradation values 0-255 in an engine and dot percent are 0 - 100%, the gradation value in an engine also increases as a drawing-number number also increases dot percent by 0% with the gradation value 0 in an engine (drawing 10 -> drawing 16), drawing 9 also increases dot percent, and dot percent have become 100% with the gradation value 255 (drawing 17) in an engine. According to this invention, the former picture over this is contained in the gradation value [in / an engine / in the data of 0 of a former picture] 4 (drawing 9), and the upper and lower sides are blank. Thus, by detaching the bottom, if there is nothing, in the case of the material and the machine of high sensitivity, or a secondary color, that a dot sticks at the time of the highlight notation will start. Conversely, at the time of data 100, after coming to the data of the former picture 99.6 (drawing 17) speaking of a shadow, Y-M-C can raise energy suddenly rather than other places by the gradation value jump ****** cage in six engine, and the thing done in this way, only when the data 100 to take out solid one distinctly come. K is in the lower berth rather than Y-M-C, and K gets down from the data of 100 by gradation value **** in 12 engines, and it is made to give energy still higher than Y-M-C to K furthermore.

[0015] At the time of the concentration calibration which is the 1st phase of color concentration adjustment, a color printer outputs a concentration calibration chart for the check of dispersion in the color concentration by ****, secular change, etc. of a color printer of an amendment sake or this amendment. Drawing 1 is explanatory drawing of the color matching method and the concentration calibration method. In drawing 1 , the data edited with edit equipment 10 are covered over the color printing machine 20, the platemaking film 40 is created, it prints with **** baking equipment 50, and the color printed matter 60 is obtained. On the other hand, the data edited with edit equipment 10 are covered over a color printer 30, and the proof picture 70 is acquired with a color-print. And a user compares the color printed matter 60 and the proof picture 70 which were acquired, and he performs color proofreading so that the proof picture 70 may be made in agreement with the color printed matter 60. This is the color matching method.

[0016] On the other hand, a concentration calibration is the concentration calibration chart (refer to drawing 6 .) outputted by the color printer 30. Density measurement of the after-mentioned is carried out with the density measurement vessel 90, the measurement result of color concentration is put into edit equipment 10 with a personal computer, and the image data included in edit equipment 10 is changed based on this. If put by edit equipment 10 into now, for example, image data to print from a color scanner 99 as one example, after changing image data based on a measurement result in edit equipment 10, it will come to send the right data to a color printer 30.

[0017] The color printer 30 of drawing 1 is look-up table operation part (henceforth.). It is called "LUT". It consists of 31, the head driver 32, the head 33, a controller (CPU) 34, a motor driver 35, and a motor 36. The strobe pulse width of face (microsecond) corresponding to the gradation value of 0-255 is made from LUT31, it drives by the head driver 32 and the energy corresponding to the head 33 is given. Moreover, the inside of edit equipment 10 has become like drawing 2 .

[0018] In drawing 2 , CPU101, program memory 102, RAM103, a keyboard or a mouse 104, a display 105, data memory 107, and the input/output interface circuit 108 are connected with edit equipment 10 at the system bus 106. The color scanner 99, the color printer 30, and the color printing machine 20 are connected with the input/output interface circuit 108. Programs, such as rate conversion of half-tone-dot area and a printer condition amendment operation, are stored in program memory 102. Image data, C-M-Y-K data, chart data, etc. are stored in RAM103. The concentration calibration 1D (dimension) table 1071 and the gray amendment 1D (dimension) table 1072 are stored in data memory 107. The inverse function corresponding to the concentration calibration chart 80 of drawing 1 is contained in the concentration calibration 1D (dimension) table 1071. In fact, the data which came from the color scanner 99 are put in by the C-M-Y-K data of RAM103 through the input/output interface circuit 108 and a system bus 106, are amended using the data here, and are outputted to a color printer 30. The soft composition in a color printer 30 is shown in drawing 3 .

[0019] In drawing 3 , there is memory 34 in a color printer 30 with the color-correction operation part 301, the data output section 302, and the synthetic operation part 303. Two or more each tables of the printing condition amendment data 3041, the standard color conversion data 3042, the 1-dimensional concentration calibration table 3043, and the 1-dimensional gray amendment table 3044 are prepared for memory 34. They are put in by the synthetic operation part 303, and both the printing condition amendment data 3041 which are the element which should amend others, the standard color conversion data 3042, and the data of the 1-dimensional gray amendment table 3044 are put into the data of the 1-dimensional concentration calibration table 3043 by the synthetic operation part 303, the value by which the synthetic operation was carried out altogether is sent to the color-correction operation part 301, and they make the synthetic look-up table 311. And the C-M-Y-K data which came from previous edit equipment 10 are outputted to the

data output section 302 by the operation of a color correction by one conversion using this look-up table 311.
[0020] The concentration calibration chart for performing a concentration calibration is shown in drawing 6 . Like illustration, the concentration calibration chart consists of two or more rectangles (it is henceforth called a "color patch".) to which the printed output of the specified dot percent concentration was gradually carried out respectively from 0% to 100% about each color of C-M-Y. Moreover, with this concentration calibration chart, in order to show a density range clearly, the color patch of the maximum concentration (100%) has been arranged in the head section, and the color patch of the minimum concentration (0%) is arranged to the degree. And intermediate gradation is arranged in descending of concentration. In the 1st phase of color concentration adjustment, an operator prints a concentration calibration chart for the data of the dot percent specified using the color printer 30 about Y-M-C-K, respectively, and measures the concentration of each color patch with the density measurement vessel 90. Although it is good if this measured value suits target network percent then, when not correct, the concentration calibration table 1071 is made so that it may double with a standard, and an amendment's is a concentration calibration about the original data. That is, if it measures with the density measurement vessel 90, when a color is thin, the concentration calibration table 1071 will be created for the original data to the somewhat deep eye. When the table of drawing 9 - drawing 17 explained and it is judged that it is necessary to make it deep to a slight degree as a result of measuring, at least two masses should just shift the whole number of a table downward, and it will be said that at least two masses should just shift the whole number of a table upwards to make it thin conversely.
[0021] The example of this invention which made fine the unit before and behind a highlight and a shadow is shown in the concentration calibration chart of drawing 6 . It considers as the gradation value in the 255th print engine, and maximum concentration dot percent 100% is taken as the gradation value in the 4th print engine minimum concentration dot percent 0%. although a highlight is gradually approached at the interval illustrating the meantime, the gradation value interval [in / a print engine / at a shadow side and a highlight side / in the gradation value (impression energy) in a print engine] is choked up -- so much (at dot percent 95%-75%, it decreases with the gradation values 4-6 in a print engine a shadow side.) Moreover, at 30% - 5%, it decreases with the gradation values 3-5 in a print engine a highlight side. In halftone, the gradation value interval in a print engine is coarse (at dot percent 75%-40%, it decreases with the gradation value 20 in a print engine.). It is avoidable that a point is attached to ** highlight which is easy to notice the eyes of the user in the case of half-tone-dot gradation since the unit before and behind a highlight and a shadow is color-printed using the patch for concentration calibrations made fine in this way according to this invention, and that the part which is not destroyed by ** solid is generated, and since tolerance is higher than a highlight and a shadow even if it has shifted, some intermediate gradation does not interfere at all practically. The patch for concentration calibrations which made fine the unit before and behind the highlight of drawing 6 and a shadow is shown to the right-hand side edge of a table by black Mull by the table of drawing 9 - drawing 17 .
[0022] It is as follows when explanation of the concentration calibration of this invention explained above is summarized.
1. gradation compression -- secured [of the highlight side margin for :(1) high order color property (2.3.4th color sensitizing) amendment]: -- by the thermal recording system, even if it actually gives impression energy, the insensible field (a dot is not attached) out of which concentration does not come exists the color printer of a thin film imprint method -- monochrome (it records on a receiver sheet) -- this field -- being large (the energy to which a dot begins to be attached being high) -- above a secondary color (it records on a front record dot and on the outskirts of it), this field becomes narrower (the energy to which a dot begins to be attached is) than monochrome (Drawing 8 B)
For this reason, in a monochromatic property, if reappearance of the impression energy-dot percent of a color printer is designed, a highlight side will be attached suddenly, will cause a tone jump, and will fail above a secondary color (drawing 8 A). By taking beforehand the large margin by the side of the highlight of a gradation design like drawing 7 B, the breakdown more than a secondary color can be prevented like drawing 8 B. It is made in agreement [with a color table] about the deviation more than primary a color and a secondary color by conversion.
(2) Reservation of a concentration calibration margin : in a color printer, change of monochrome sensitivity may arise according to factors, such as a machine difference, a sensitized material, and a Lot difference. After designing reappearance of the impression energy-dot percent of a printer in the average monochrome property which combines and comes out, when it becomes combination with low sensitivity, 100% (solid) will stop under the present circumstances, crushing. (Drawing 8 A3)
By preparing the margin by the side of the shadow of a gradation design like drawing 7 B, the solid reappearance in low sensitivity can be guaranteed like drawing 8 B (since it has taken widely by (1), the margin by the side of the highlight in the case of high sensitivity is guaranteed). This prints a monochromatic wedge and amends it by carrying out density measurement -> amendment curve calculation (concentration calibration).
[0023] 2. endpoint move ("heat" and solid point movement): -- a point and the facet (standup) of (1) 1 heat highlight --

in order to improve solid crushing of a product, the point of output side gradation is assigned to 0% of former data Under the present circumstances, in consideration of the phenomenon of 1-(1) and (2), a point is not attached in high sensitivity combination and a high order color, either. It is designing so that the impression energy which is the grade from which tailing (with a dot) does not happen after solid printing may start. giving and warming weak energy also by the non-picture portion on a head -- a point and the facet (standup) of a highlight -- solid crushing of a product is improvable

(2) Solid point movement (an improvement of solid crushing and prevention of eye generating) : although solid one is crushed also by the solid point [the gradation value 244 in drawing 17 and a print engine] which moved by gradation compression for 1-(2) and the maximum concentration comes out of a design top in the center of the patch for density measurement (about 1cmx1cm), crushing of a point is improving the concentration fall in the patch periphery. Although this poses a problem by the smaller solid picture, this problem cannot be amended in a concentration calibration with the density measurement machine which measures the center of a patch. For this reason, only the point of 100% of inputs is shifted to the high-energy side by six gradation (/255) by C-M-Y-K from the solid point [the gradation value 244 in drawing 17 and a print engine] which moved by gradation compression. (Adjustable.) [-- from the solid point by which amendment calculation was carried out by the concentration calibration -- always -- 6 gradation shift]

Furthermore, in K, in order to make reappearance (shut) of a thin line and a character improve, the point of 100% of inputs moves to the point of the maximum energy [the gradation value 255 in drawing 17 and a print engine] (fixation). A reason is because the phenomenon overheat "was not made into the point of the maximum energy" by C-M-Y-K, "was made adjustable" with the reason and to which the center section of the dot will fall out white and concentration will fall if energy is applied too much in a color printer may arise, and is because this overheat and solid crushing are reconciled. In K, since generating of this eye was comparatively weak, priority was given to reappearance (shut) of a thin line and a character, and it moved to the maximum energy.

[0024] It carried out using the printer of the following example by having made the above method into the color printer, and the effect was checked.

a. An example, a condition, and a printer : digital color proof by Fuji Photo Film Co., Ltd. FIRSTPROOF Printer.

- Laminator : digital color proof by Fuji Photo Film Co., Ltd. FIRSTPROOF Laminator.
- television sheet: -- digital color proof by Fuji Photo Film Co., Ltd. FIRSTPROOF a ** -- receiver sheet A3W
- Hot printing ribbon : digital color proof FIRSTPROOF by Fuji Photo Film Co., Ltd. ** proof ribbon J.
- Our paper : **** art paper.

The television sheet and the hot printing ribbon used the record material of a thin film hot printing method. The coloring-material layer thickness of an ink ribbon is less than 1 micrometer, and about 0.3 micrometers, since it is very thin, and since [desirable], the material of this method has high resolution compared with other hot printing methods, and can form a fine dot stably.

[0025] As other uses considered, they are not only hot printing but electrophotography, an ink jet, a color sensible heat, and Toner. Color printers, such as Jet and an ion flow, also have the same effective policy.

[0026]

[Effect of the Invention] Even if it checks a dot with a magnifier since other colors are not mixed in a primary color according to this invention as explained above, there is no sense of incongruity. A crevice becomes impossible to solid one. K characters carry out distinctly. The precision of a concentration calibration increases. Even if the sensitivity of a secondary color increases from a primary color therefore, it is hard coming to generate the trouble where a bad dot will be printed. The check of whether if the above method is used together, the data of another color will be mixed to ** print data (1-claim 2 correspondence), ** The check of whether the solid section of print data is solid exactly (claim 3 correspondence), ** All of the check item of the check (claim 4 correspondence) of the size of a character, a ** highlight, and main color proofs of the gradation of a shadow called especially the check (5-6-7-8-9-claim 10 correspondence) of the continuity of gradation can attain.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
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[The technical field to which invention belongs] this invention relates to the printer which can do the color conversion method and the concentration gradation amendment method of the printer for mainly creating the color proof for printing which creates a color picture, and it.
[0002]
[Description of the Prior Art] When creating a color proof using the color conversion (it is henceforth called "color matching".) technology of aligning a color-print with printed matter, the same color matching technique as usual is used. That is, the method of once changing yellow (Y), a Magenta (M), cyanogen (C), and black (K) data into a chromaticity value generally, and changing it into C-M-Y-K data peculiar to a print system through a translation table again is used. This is the color matching technique which has come out to the commercial scene as "Color Sync" (tradename) and which was known well.
[0003] Moreover, the concentration calibration technology carried out to an amendment sake in the sensitivity difference of material or a machine is indicated by Japanese Patent Application No. No. 126108 [09 to] of point ** concerning the same applicant. According to the concentration calibration technology, the interval of specification network % is fixed.
[0004]
[Problem(s) to be Solved by the Invention] However, there were the respectively following problems in the two above-mentioned conventional methods. first, if color matching is applied to pure colors, such as red (R), blue (B), green (G), and Y, M, C, when creating a color proof using the color matching technology of the former conventional technology, when the hue of a coloring material has shifted from the target hue, it may happen that the highlight which is the color of slightly others is mixed with a pure color In order to check the rightness of image data, if a user does check work with a magnifier, in the case of half-tone-dot gradation (it is hard to be checked by looking in the case of concentration gradation.), the following problems will occur the color proof created in this way. That is, if the hue of a coloring material has shifted from the target hue when the conventional color matching is applied to consisting of only a Magenta (M) and yellow (Y), that cyanogen (C) is mixed can awake red (R), for example. Now, it is the problem which will have misunderstanding if the original data are wrong, since cyanogen (C) is mixed while the user is checking with the magnifier that it is data of a Magenta (M) and yellow (Y). Thus, although original former data were right, when Calah-matching was applied, it might happen that the color of slightly others is mixed with a pure color in this way.
[0005] Moreover, in the case of the 2nd conventional technology using a concentration calibration, there were the following troubles.
1) in the case of half-tone-dot gradation, unlike concentration gradation, it is solid (namely, a shadow, 100% of gradation) -- or it will be easily recognized with a magnifier whether it is 99% That is, it is the problem that will discover a white omission in some places if the user is looking with the magnifier in order to be easy to discover the white omission in solid one and to check that it is solid, have misunderstanding as the original data are wrong, and a check is not made.
2) When it is especially black, the operating frequency of the character using solid one is high, since a size also needs to be strictly right and it is [it becomes thin and] visible, when the way of the edge of a character becomes blurred, in order to lose this, 99% of gradation is inadequate, and it must become 100% of gradation certainly.
3) Even if it changes the sensitivity performance of material or a machine, you always have to solve the above-mentioned technical problem. Therefore, it is necessary to carry out concentration carry BURESHOYON which abolishes the sensitivity performance difference of material or a machine. In the case of half-tone-dot gradation, and it

did not attach whether the point of ** highlight would stick or ** solid is crushed, it has not blurred, or especially ** is important. Even if some intermediate gradation has shifted, its tolerance is higher than a highlight and a shadow. Then, the precision of a highlight and a solid concentration calibration needed to be raised.
4) The direction more than a secondary color may have the sensitivity of record material higher than a primary color. In this case, in case a concentration calibration is carried out in a primary color, the degree of margin for reproducing gradation continuously above a secondary color is the problem that a highlight side runs short of. Moreover, since the sensitivity performance changed with a material difference and machine differences, in the case of the low material and the machine of sensitivity, a shadow could not be made, and it happened that a highlight cannot be made in the case of material and a machine with high sensitivity.
5) Although it is made to improve with [of a highlight] a point by given and warming weak energy on a non-picture portion or a head from before, in a highlight, the dot has stuck also in the non-picture portion in this case above a secondary color.
this invention solves these above-mentioned technical problems, and moreover it seems that it does not give misapprehension as former data are wrong to the user, it offers the concentration gradation amendment method which does not depend a material difference, a machine difference, and more than a secondary color, but can be formed from a highlight to a shadow.
[0006]
[Means for Solving the Problem] In order to solve the technical problem of the above [0004], invention concerning this application claims 1 and 2 is characterized by using 0% about the color concerned which is 0%, when at least 1 colors, such as the special features, such as R-G-B-GOLD, are 0% at a coloring material, i.e., a C-M-Y-K pan, in the case of the color conversion of 3-dimensional one or more by color matching.
[0007] Moreover, in order to solve the technical problem of the above [0005], invention to which it presupposes only the solid gradation of a shadow that invention concerning a claim 3 is characterized by usually making an energy difference larger than gradation, and it starts a claim 4 is characterized by only K making the difference larger than other C-M-Y-K in the concentration gradation amendment method according to claim 3. Moreover, invention which invention concerning a claim 5 carries out a concentration calibration using the patch for concentration calibrations which made fine the unit before and behind a highlight and a shadow, and relates to a claim 6 is characterized by having the patch for concentration calibrations which made fine the unit before and behind a highlight and a shadow. Furthermore, invention concerning a claim 7 is characterized by taking energy margin width of face to a highlight and shadow side, and is characterized by taking the energy margin width of face larger than a shadow side by the side of a highlight in that case. And invention concerning a claim 9 is faced giving energy weak also on the head of a non-picture portion at the time of a primary color, and the strength of the energy is characterized by being the value which is the grade by which a dot is not printed by the non-picture portion at the time more than a secondary color.
[0008]
[Embodiments of the Invention] Hereafter, the concentration gradation amendment method of the printer which creates a color picture by the thermal head of this invention, and its color printer are explained in detail with reference to a drawing. First, when at least 1 color of C-M-Y-K is 0% in the case of color conversion given in the above [0006], it explains using 0% about the color concerned which is 0%. For example, in the case of the combination of the color of Y-M-C, a 3-dimensional look-up table like drawing 5 can be considered. In drawing 5 , a zero can consider the model which Y and the Y-axis called M by C, and the Z-axis called [the X-axis] 100% of cube at 0%, red (R) is on the diagonal line of Y and M, green (G) is on the diagonal line of C and Y, and blue (B) has it on the diagonal line of M and C. Moreover, it will become a sour orange, if red (R) approaches M on an Y-M side and purplish red and Y will be approached. this 3-dimensional look-up table -- every -- the time of former data called Y-M-C being given -- respectively -- Y -- the matrix of changing into '-M'-C' is contained in this 3-dimensional look-up table Furthermore, if K (black) is also added, the 4-dimensional look-up table expressed to drawing 4 can be considered. The matrix of a look-up table is decided by survey about the total color by both printed matter and the color printer. Therefore, when the 3-dimensional [or more] look-up table determined by survey is used, even if a target is a pure color, if a target pure color is printed by the color printer, there are not few cases where the direction where colors other than a pure color were mixed becomes a chromaticity value more near the pure color, in fact. For example, when the direction whose C is 1% is closer to the color of the target than the place whose C is 0% making the C0% color print by the color printer though C is 0% of color, a color proof will be made from C= 1% of value. When are done so and a user sees this color proof with a magnifier, C will be easily noticed being mixed with the place where C should not be mixed (on the other hand, even if C is contained in the place whose C should be 16%, for example 17%, a user hardly notices this difference.), and the misapprehension whether this data is mistaken will be given. Then, it is this invention to use 0% about 0% of the color concerned, (even if it is the case where a hue suits further the direction where 0% of

the color was originally mixed), only when at least 1 color of C-M-Y-K is the print of the color proof which is 0%. In a 3-dimensional example, the color whose at least 1 color of C-M-Y is 0% points out three cubical ridgeline C-M-Y, three cubical diagonal line B-R-B, the color on an Y-M side (for example, orange), the color on a M-C side (for example, purple-blue), and the color on a C-Y side (for example, yellowish green). Only when at least 1 color of such C-M-Y is a color which is 0%, suppose that it is dealt with as mentioned above.

[0009] What is necessary is just to make it what made 0% gradation of the color concerned energy fixation, when at least 1 color of C-M-Y-K in which C-M-Y or K also specifically included the translation table used in the case of a concentration calibration is 0%. If a color proof is created using the translation table carried out in this way, cannot cause a user's misapprehension and it can be carried out. If near of the hue of a pigment is carried out very much to the ink of printing, un-arranging [that a hue changes a lot] will not happen, either.

[0010] next, concentration gradation assistant ** given in the above [0007] -- just -- ******** The graph of drawing 7 (A) is the curve of a monochrome gradation reappearance target, and it is the dot percent when measuring a horizontal axis at the dot percent of a former picture, and measuring a vertical axis with a reflection density measuring instrument. Reflection density is dot percent reappearance (dot %) by MARE Davis's formula. Namely, in order to judge this with not special measurement but the concentration meter of image analysis etc., The amount of optical dot gain of a color proof is assumed to be color art [by Fuji Photo Film Co., Ltd.] CR-T3 EQC. Color art Dot percent calculated by MARE Davis's formula from the reflection density of CR-T3 are set as a reappearance target. a former picture (input digital data) -- receiving -- our paper of the output picture of a color printer -- it is making for the color proof half-tone-dot area reappearance after an imprint to be in agreement into the ideal (target)

[0011] In this invention, compression and endpoint movement of the gradation shown in the graph of drawing 7 (B) by this invention in mounting to the color printer for color proofs were given, and this was considered as the monochrome reappearance curve of a color printer so that the above-mentioned reappearance target could be attained also in all cases. That is, the graph of drawing 7 (B) is the gradation value (record energy) highest [in / a color printer engine / a horizontal axis is a gradation design, and 256 ****s is carried out from 0 from the right to the left, and / in the right], and the left is the gradation value zero in a color printer engine. The feature of this graph is becoming black solid [of the dot percent reappearance 100] in the horizontal-axis number 244, and having become the highlight of the dot percent reappearance 0 in the horizontal-axis number 39. That is, it is the feature of this invention to have set it as per [instead of 255 of a horizontal axis] 244 that the standup of a highlight of the dot percent reappearance 0 starts from per [instead of 0] 39, and reaches black solid of the dot percent reappearance 100. 0-39,244-255 of a horizontal axis are called degree of margin by this invention here.

[0012] The need for this degree of margin is explained using the graph of drawing 8 (A) which is a method by the conventional concentration calibration, and the graph of drawing 8 (B) by this invention. The ideal (target) curve of drawing 7 (A) is drawn on drawing 8 (A) as the solid line, and the dot percent curve of the ideal (target) of drawing 7 (B) is drawn on drawing 8 (B) as the solid line. a high sensitivity graph (dashed line) when material and a machine use a high sensitivity thing on the left-hand side of each ideal solid line curve of both graphs -- right-hand side -- material and a machine -- low -- the low sensitivity graph (two-dot chain line) at the time of using a sensitivity thing is drawn Dot percent are also called half-tone-dot %, and are the rate of area of the ink printed (print). If the graph of drawing 8 (A) is seen, at the time of impression energy 0%, dot reappearance % is also 0 and, as for the ideal solid line curve, dot reappearance % has also become 100 at the time of impression energy 100%. However, in the graph of drawing 8 (A), when a thing with a material difference or a machine difference is used, even if it applies the same energy, it happens to change dot percent. In a shadow and a highlight, when there is no margin in right and left, the following problems arise. For example, when it is the material and the machine whose sensitivity is too low, it becomes a two-dot chain line low sensitivity graph on the right-hand side of an ideal solid line curve. If it does so, dot reappearance % has finished near 97% at the time of impression energy 100%, without being set to 100. That is, it happens that dot percent 100% which is full gradation cannot be taken out with a shadow side. When the machine of the case where it is material with similarly high sensitivity, or high sensitivity is used, it becomes a dashed-line high sensitivity graph on the left-hand side of an ideal solid line curve. If it does so, dot percent are finished as per 3% at the time of impression energy 0%, without being set to 0. That is, it happens that it becomes impossible to take out highlight 0% shortly. Furthermore, there is an inclination for the sensitivity of material to be [the direction more than a secondary color] high (that is, for dot percent to come out mostly rather than a primary color in the secondary color even if it gives the same energy), rather than monochrome (primary color). The graph which shows the inclination is drawn by the dotted line by drawing 8 (A). Also in this case, the same inclination as the case of the material and the machine of previous high sensitivity is shown, and expression of a highlight will become impossible if it is the conventional method.

[0013] On the other hand, since the degree of margin looked at by drawing 8 (B) is made according to the amendment method of this invention, also in the case of the material and the machine of ** low sensitivity, also in the case of the

material and the machine of ** high sensitivity, dot percent can reappear to 0 - 100% also in ** color [secondary] printing.

[0014] The table is carried for the concentration calibration table which realizes the amendment method of this invention by drawing 9 - drawing 17 . This table is the thing of gradation design 256 gradation, the gradation values 0-255 in an engine and dot percent are 0 - 100%, the gradation value in an engine also increases as a drawing-number number also increases dot percent by 0% with the gradation value 0 in an engine (drawing 10 -> drawing 16), drawing 9 also increases dot percent, and dot percent have become 100% with the gradation value 255 (drawing 17) in an engine. According to this invention, the former picture over this is contained in the gradation value [in / an engine / in the data of 0 of a former picture] 4 (drawing 9), and the upper and lower sides are blank. Thus, by detaching the bottom, if there is nothing, in the case of the material and the machine of high sensitivity, or a secondary color, that a dot sticks at the time of the highlight notation will start. Conversely, at the time of data 100, after coming to the data of the former picture 99.6 (drawing 17) speaking of a shadow, Y-M-C can raise energy suddenly rather than other places by the gradation value jump ****** cage in six engine, and the thing done in this way, only when the data 100 to take out solid one distinctly come. K is in the lower berth rather than Y-M-C, and K gets down from the data of 100 by gradation value **** in 12 engines, and it is made to give energy still higher than Y-M-C to K furthermore.

[0015] At the time of the concentration calibration which is the 1st phase of color concentration adjustment, a color printer outputs a concentration calibration chart for the check of dispersion in the color concentration by ****, secular change, etc. of a color printer of an amendment sake or this amendment. Drawing 1 is explanatory drawing of the color matching method and the concentration calibration method. In drawing 1 , the data edited with edit equipment 10 are covered over the color printing machine 20, the platemaking film 40 is created, it prints with **** baking equipment 50, and the color printed matter 60 is obtained. On the other hand, the data edited with edit equipment 10 are covered over a color printer 30, and the proof picture 70 is acquired with a color-print. And a user compares the color printed matter 60 and the proof picture 70 which were acquired, and he performs color proofreading so that the proof picture 70 may be made in agreement with the color printed matter 60. This is the color matching method.

[0016] On the other hand, a concentration calibration is the concentration calibration chart (refer to drawing 6 .) outputted by the color printer 30. Density measurement of the after-mentioned is carried out with the density measurement vessel 90, the measurement result of color concentration is put into edit equipment 10 with a personal computer, and the image data included in edit equipment 10 is changed based on this. If put by edit equipment 10 into now, for example, image data to print from a color scanner 99 as one example, after changing image data based on a measurement result in edit equipment 10, it will come to send the right data to a color printer 30.

[0017] The color printer 30 of drawing 1 is look-up table operation part (henceforth.). It is called "LUT". It consists of 31, the head driver 32, the head 33, a controller (CPU) 34, a motor driver 35, and a motor 36. The strobe pulse width of face (microsecond) corresponding to the gradation value of 0-255 is made from LUT31, it drives by the head driver 32 and the energy corresponding to the head 33 is given. Moreover, the inside of edit equipment 10 has become like drawing 2 .

[0018] In drawing 2 , CPU101, program memory 102, RAM103, a keyboard or a mouse 104, a display 105, data memory 107, and the input/output interface circuit 108 are connected with edit equipment 10 at the system bus 106. The color scanner 99, the color printer 30, and the color printing machine 20 are connected with the input/output interface circuit 108. Programs, such as rate conversion of half-tone-dot area and a printer condition amendment operation, are stored in program memory 102. Image data, C-M-Y-K data, chart data, etc. are stored in RAM103. The concentration calibration 1D (dimension) table 1071 and the gray amendment 1D (dimension) table 1072 are stored in data memory 107. The inverse function corresponding to the concentration calibration chart 80 of drawing 1 is contained in the concentration calibration 1D (dimension) table 1071. In fact, the data which came from the color scanner 99 are put in by the C-M-Y-K data of RAM103 through the input/output interface circuit 108 and a system bus 106, are amended using the data here, and are outputted to a color printer 30. The soft composition in a color printer 30 is shown in drawing 3 .

[0019] In drawing 3 , there is memory 34 in a color printer 30 with the color-correction operation part 301, the data output section 302, and the synthetic operation part 303. Two or more each tables of the printing condition amendment data 3041, the standard color conversion data 3042, the 1-dimensional concentration calibration table 3043, and the 1-dimensional gray amendment table 3044 are prepared for memory 34. They are put in by the synthetic operation part 303, and both the printing condition amendment data 3041 which are the element which should amend others, the standard color conversion data 3042, and the data of the 1-dimensional gray amendment table 3044 are put into the data of the 1-dimensional concentration calibration table 3043 by the synthetic operation part 303, the value by which the synthetic operation was carried out altogether is sent to the color-correction operation part 301, and they make the synthetic look-up table 311. And the C-M-Y-K data which came from previous edit equipment 10 are outputted to the

data output section 302 by the operation of a color correction by one conversion using this look-up table 311.
[0020] The concentration calibration chart for performing a concentration calibration is shown in drawing 6 . Like illustration, the concentration calibration chart consists of two or more rectangles (it is henceforth called a "color patch".) to which the printed output of the specified dot percent concentration was gradually carried out respectively from 0% to 100% about each color of C-M-Y. Moreover, with this concentration calibration chart, in order to show a density range clearly, the color patch of the maximum concentration (100%) has been arranged in the head section, and the color patch of the minimum concentration (0%) is arranged to the degree. And intermediate gradation is arranged in descending of concentration. In the 1st phase of color concentration adjustment, an operator prints a concentration calibration chart for the data of the dot percent specified using the color printer 30 about Y-M-C-K, respectively, and measures the concentration of each color patch with the density measurement vessel 90. Although it is good if this measured value suits target network percent then, when not correct, the concentration calibration table 1071 is made so that it may double with a standard, and an amendment's is a concentration calibration about the original data. That is, if it measures with the density measurement vessel 90, when a color is thin, the concentration calibration table 1071 will be created for the original data to the somewhat deep eye. When the table of drawing 9 - drawing 17 explained and it is judged that it is necessary to make it deep to a slight degree as a result of measuring, at least two masses should just shift the whole number of a table downward, and it will be said that at least two masses should just shift the whole number of a table upwards to make it thin conversely.
[0021] The example of this invention which made fine the unit before and behind a highlight and a shadow is shown in the concentration calibration chart of drawing 6 . It considers as the gradation value in the 255th print engine, and maximum concentration dot percent 100% is taken as the gradation value in the 4th print engine minimum concentration dot percent 0%. although a highlight is gradually approached at the interval illustrating the meantime, the gradation value interval [in / a print engine / at a shadow side and a highlight side / in the gradation value (impression energy) in a print engine] is choked up -- so much (at dot percent 95%-75%, it decreases with the gradation values 4-6 in a print engine a shadow side.) Moreover, at 30% - 5%, it decreases with the gradation values 3-5 in a print engine a highlight side. In halftone, the gradation value interval in a print engine is coarse (at dot percent 75%-40%, it decreases with the gradation value 20 in a print engine.). It is avoidable that a point is attached to ** highlight which is easy to notice the eyes of the user in the case of half-tone-dot gradation since the unit before and behind a highlight and a shadow is color-printed using the patch for concentration calibrations made fine in this way according to this invention, and that the part which is not destroyed by ** solid is generated, and since tolerance is higher than a highlight and a shadow even if it has shifted, some intermediate gradation does not interfere at all practically. The patch for concentration calibrations which made fine the unit before and behind the highlight of drawing 6 and a shadow is shown to the right-hand side edge of a table by black Mull by the table of drawing 9 - drawing 17 .
[0022] It is as follows when explanation of the concentration calibration of this invention explained above is summarized.
1. gradation compression -- secured [of the highlight side margin for :(1) high order color property (2.3.4th color sensitizing) amendment]: -- by the thermal recording system, even if it actually gives impression energy, the insensible field (a dot is not attached) out of which concentration does not come exists the color printer of a thin film imprint method -- monochrome (it records on a receiver sheet) -- this field -- being large (the energy to which a dot begins to be attached being high) -- above a secondary color (it records on a front record dot and on the outskirts of it), this field becomes narrower (the energy to which a dot begins to be attached is) than monochrome (Drawing 8 B)
For this reason, in a monochromatic property, if reappearance of the impression energy-dot percent of a color printer is designed, a highlight side will be attached suddenly, will cause a tone jump, and will fail above a secondary color (drawing 8 A). By taking beforehand the large margin by the side of the highlight of a gradation design like drawing 7 B, the breakdown more than a secondary color can be prevented like drawing 8 B. It is made in agreement [with a color table] about the deviation more than primary a color and a secondary color by conversion.
(2) Reservation of a concentration calibration margin : in a color printer, change of monochrome sensitivity may arise according to factors, such as a machine difference, a sensitized material, and a Lot difference. After designing reappearance of the impression energy-dot percent of a printer in the average monochrome property which combines and comes out, when it becomes combination with low sensitivity, 100% (solid) will stop under the present circumstances, crushing. (Drawing 8 A3)
By preparing the margin by the side of the shadow of a gradation design like drawing 7 B, the solid reappearance in low sensitivity can be guaranteed like drawing 8 B (since it has taken widely by (1), the margin by the side of the highlight in the case of high sensitivity is guaranteed). This prints a monochromatic wedge and amends it by carrying out density measurement -> amendment curve calculation (concentration calibration).
[0023] 2. endpoint move ("heat" and solid point movement): -- a point and the facet (standup) of (1) 1 heat highlight --

in order to improve solid crushing of a product, the point of output side gradation is assigned to 0% of former data Under the present circumstances, in consideration of the phenomenon of 1-(1) and (2), a point is not attached in high sensitivity combination and a high order color, either. It is designing so that the impression energy which is the grade from which tailing (with a dot) does not happen after solid printing may start. giving and warming weak energy also by the non-picture portion on a head -- a point and the facet (standup) of a highlight -- solid crushing of a product is improvable

(2) Solid point movement (an improvement of solid crushing and prevention of eye generating) : although solid one is crushed also by the solid point [the gradation value 244 in drawing 17 and a print engine] which moved by gradation compression for 1-(2) and the maximum concentration comes out of a design top in the center of the patch for density measurement (about 1cmx1cm), crushing of a point is improving the concentration fall in the patch periphery. Although this poses a problem by the smaller solid picture, this problem cannot be amended in a concentration calibration with the density measurement machine which measures the center of a patch. For this reason, only the point of 100% of inputs is shifted to the high-energy side by six gradation (/255) by C-M-Y-K from the solid point [the gradation value 244 in drawing 17 and a print engine] which moved by gradation compression. (Adjustable.) [-- from the solid point by which amendment calculation was carried out by the concentration calibration -- always -- 6 gradation shift]

Furthermore, in K, in order to make reappearance (shut) of a thin line and a character improve, the point of 100% of inputs moves to the point of the maximum energy [the gradation value 255 in drawing 17 and a print engine] (fixation). A reason is because the phenomenon overheat "was not made into the point of the maximum energy" by C-M-Y-K, "was made adjustable" with the reason and to which the center section of the dot will fall out white and concentration will fall if energy is applied too much in a color printer may arise, and is because this overheat and solid crushing are reconciled. In K, since generating of this eye was comparatively weak, priority was given to reappearance (shut) of a thin line and a character, and it moved to the maximum energy.

[0024] It carried out using the printer of the following example by having made the above method into the color printer, and the effect was checked.

a. An example, a condition, and a printer : digital color proof by Fuji Photo Film Co., Ltd. FIRSTPROOF Printer.

- Laminator : digital color proof by Fuji Photo Film Co., Ltd. FIRSTPROOF Laminator.
- television sheet: -- digital color proof by Fuji Photo Film Co., Ltd. FIRSTPROOF a ** -- receiver sheet A3W
- Hot printing ribbon : digital color proof FIRSTPROOF by Fuji Photo Film Co., Ltd. ** proof ribbon J.
- Our paper : **** art paper.

The television sheet and the hot printing ribbon used the record material of a thin film hot printing method. The coloring-material layer thickness of an ink ribbon is less than 1 micrometer, and about 0.3 micrometers, since it is very thin, and since [desirable], the material of this method has high resolution compared with other hot printing methods, and can form a fine dot stably.

[0025] As other uses considered, they are not only hot printing but electrophotography, an ink jet, a color sensible heat, and Toner. Color printers, such as Jet and an ion flow, also have the same effective policy.

[0026]

[Effect of the Invention] Even if it checks a dot with a magnifier since other colors are not mixed in a primary color according to this invention as explained above, there is no sense of incongruity. A crevice becomes impossible to solid one. K characters carry out distinctly. The precision of a concentration calibration increases. Even if the sensitivity of a secondary color increases from a primary color therefore, it is hard coming to generate the trouble where a bad dot will be printed. The check of whether if the above method is used together, the data of another color will be mixed to ** print data (1-claim 2 correspondence), ** The check of whether the solid section of print data is solid exactly (claim 3 correspondence), ** All of the check item of the check (claim 4 correspondence) of the size of a character, a ** highlight, and main color proofs of the gradation of a shadow called especially the check (5-6-7-8-9-claim 10 correspondence) of the continuity of gradation can attain.

[Translation done.]

* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] It is the color conversion method characterized by using 0% about 0% of the color concerned also after conversion when at least 1 color of the coloring material before conversion is 0% in the case of color conversion of 3-dimensional one or more.
[Claim 2] The color printer characterized by having the translation table which made 0% gradation of the color concerned energy fixation when at least 1 color of a coloring material is 0% in the case of color conversion.
[Claim 3] The concentration gradation amendment method characterized by only the solid gradation of a shadow usually making an energy difference larger than gradation.
[Claim 4] The concentration gradation amendment method characterized by only K making the difference larger than other C-M-Y in the concentration gradation amendment method according to claim 3.
[Claim 5] The concentration gradation amendment method characterized by carrying out a concentration calibration using the patch for concentration calibrations which made fine the unit before and behind a highlight and a shadow.
[Claim 6] The color printer characterized by having the patch for concentration calibrations which made fine the unit before and behind a highlight and a shadow.
[Claim 7] The concentration gradation amendment method characterized by taking energy margin width of face to a highlight and shadow side.
[Claim 8] The concentration gradation amendment method characterized by taking the energy margin width of face larger than a shadow side by the side of a highlight in the concentration gradation amendment method according to claim 7.
[Claim 9] It is the concentration gradation amendment method which faces also giving weak energy to the head of a non-picture portion at the time of a primary color, and is characterized by the strength of the energy being a value which is the grade by which a dot is not printed by the non-picture portion at the time more than a secondary color.
[Claim 10] It is the color printer characterized by facing also giving weak energy to the head of a non-picture portion at the time of a primary color, and the strength of the energy having the concentration gradation translation table made into the value which is the grade by which a dot is not printed by the non-picture portion at the time more than a secondary color.
[Claim 11] The color conversion and the concentration gradation amendment method according to claim 1 to 10, or printer which used the material of a thin film hot printing method.
[Claim 12] The color conversion and the concentration gradation amendment method which used together the color conversion method according to claim 1 and at least two concentration gradation amendment methods or more according to claim 3 to 9.
[Claim 13] The printer using color conversion and the concentration gradation amendment method according to claim 12.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is explanatory drawing of the concentration calibration method.
[Drawing 2] Explanatory drawing of edit equipment 10.
[Drawing 3] The soft block diagram in a color printer 30.
[Drawing 4] Drawing explaining the relation of C'M'Y'K' after conversion of C-M-Y-K.
[Drawing 5] 3-dimensional look-up table explanatory drawing.
[Drawing 6] Concentration calibration chart view.
[Drawing 7] Former picture pair reappearance dot percent view. (A) is a target chart and (B) is the gradation design pair reappearance dot percent view of this invention.
[Drawing 8] Impression energy pair reappearance dot percent view. Conventionally, (A) is a view and (B) is this invention view.
[Drawing 9] The 1st page of the concentration calibration table which realizes the amendment method of this invention.
[Drawing 10] The 2nd page of the concentration calibration table which realizes the amendment method of this invention.
[Drawing 11] The 3rd page of the concentration calibration table which realizes the amendment method of this invention.
[Drawing 12] The 4th page of the concentration calibration table which realizes the amendment method of this invention.
[Drawing 13] The 5th page of the concentration calibration table which realizes the amendment method of this invention.
[Drawing 14] The 6th page of the concentration calibration table which realizes the amendment method of this invention.
[Drawing 15] The 7th page of the concentration calibration table which realizes the amendment method of this invention.
[Drawing 16] The octavus page of a concentration calibration table which realizes the amendment method of this invention.
[Drawing 17] The 9th page of the concentration calibration table which realizes the amendment method of this invention.
[Description of Notations]
10 Edit Equipment
101 CPU
102 Program Memory
103 RAM
106 System Bus
107 Data Memory
1071 Concentration Calibration 1D (Dimension) Table
108 Input/output Interface Circuit
30 Color Printer
301 Color-Correction Operation Part
302 Data Output Section
303 Synthetic Operation Part
304 Memory

3041 Printing Condition Amendment Data
3042 Standard Color Conversion Data
3043 1-dimensional Concentration Calibration Table
3044 1-dimensional Gray Amendment Table
31 Look-up Table Operation Part (LUT)
311 Synthetic Look-up Table
32 Head Driver
33 Head
34 Controller (CPU)
35 Motor Driver
36 Motor
80 Concentration Calibration Chart
99 Color Scanner

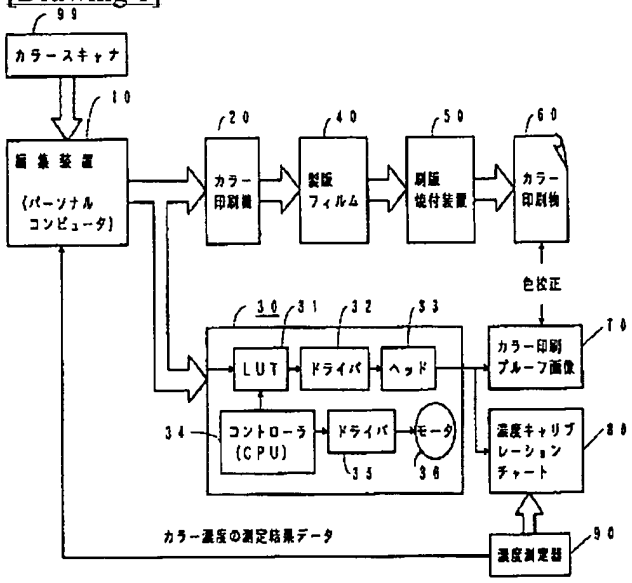
[Translation done.]

* NOTICES *

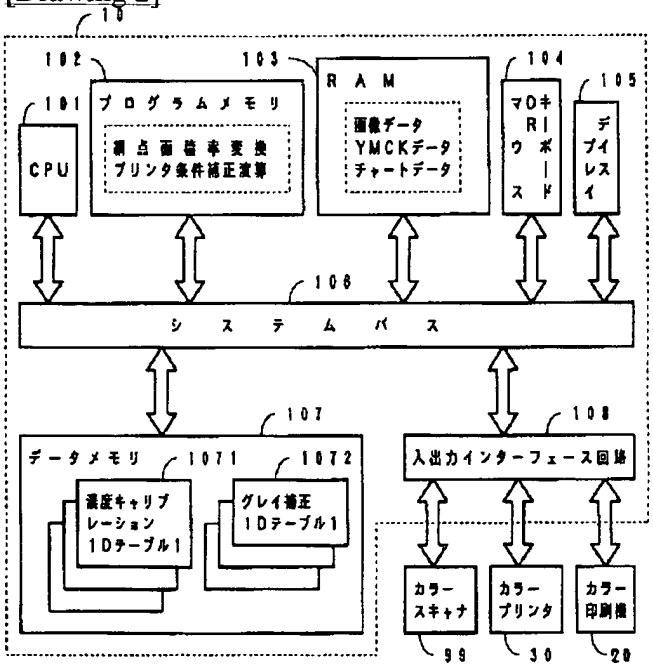
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

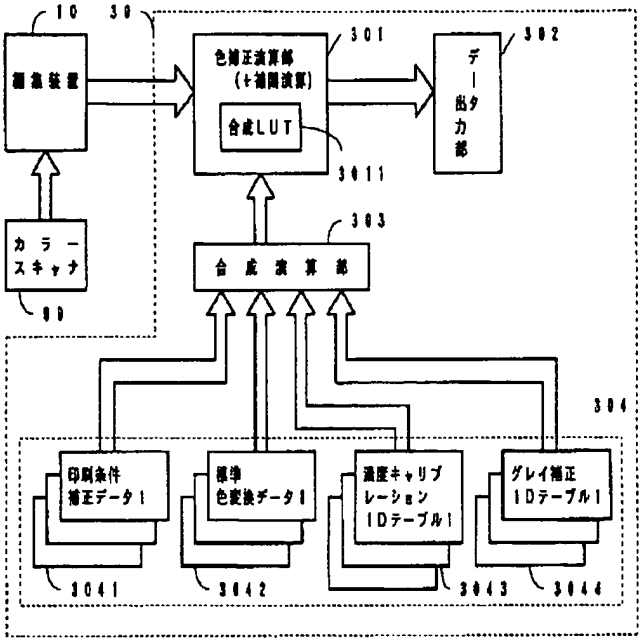
[Drawing 1]



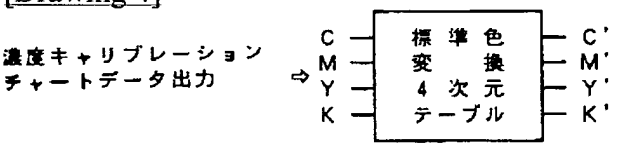
[Drawing 2]



[Drawing 3]

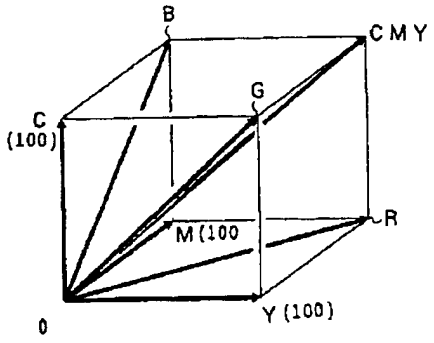


[Drawing 4]



[Drawing 5]

3次元ルックアップテーブル（ＬＵＴ）

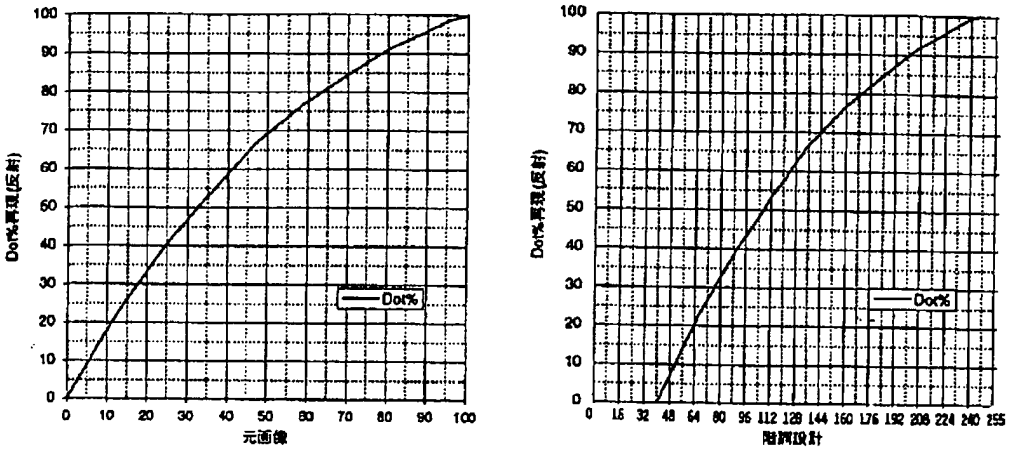


[Drawing 6]

濃度キャリブレーションチャート

識別番号	網 %	実施例	Y	M	C	K
A（最大濃度）	100 %	255				
B（最小濃度）	0 %	4				
1	100 %	249				
2	99.9%	243				
3	99.3%	239				
4	98.7%	235				
5	95.0%	220				
6	90.0%	200				
7	83.7%	180				
8	77.0%	160				
9	68.7%	140				
10	58.0%	120				
11	46.3%	100				
12	33.2%	80				
13	19.8%	62				
14	10.2%	51				
15	6.8%	47				
16	3.3%	43				
17	0.7%	40				
18	0 %	35				
19	0 %	30				

[Drawing 7]

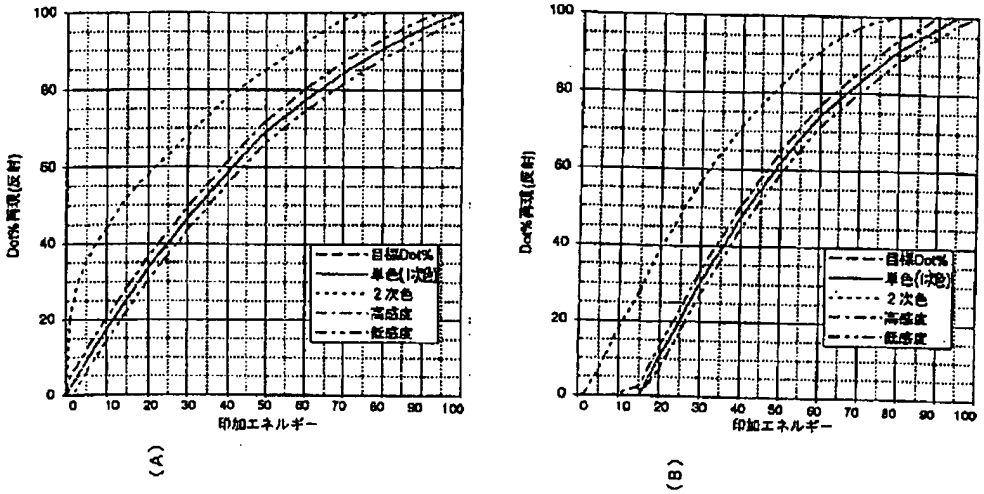


(A)　(B)

[Drawing 9]

階調設計		元画像		再現	キャリブ・チャート
エンジン階調値	パーセント	画像データ階調値	パーセント	ドット%	
0	. 0				
1	. 4				
2	. 8				
3	1. 2				
4	1. 6	0	0. 0	0. 0	
5	2. 0				
6	2. 4				
7	2. 7				
8	3. 1				
9	3. 5				
10	3. 9				
11	4. 3				
12	4. 7				
13	5. 1				
14	5. 5				
15	5. 9				
16	6. 3				
17	6. 7				
18	7. 1				
19	7. 5				
20	7. 8				
21	8. 2				
22	8. 6				
23	9. 0				
24	9. 4				
25	9. 8				
26	10. 2				
27	10. 6				

[Drawing 8]



[Drawing 10]

階調設計		元画像		再現	キャリブ・チャート
エンジン階調値	パーセント	画像データ階調値	パーセント	ドット%	
28	11.0				
29	11.4				
30	11.8				
31	12.2				
32	12.5				
33	12.9				
34	13.3				
35	13.7				
36	14.1				
37	14.5				
38	14.9				
39	15.3				
40	15.7	1	0.4	0.7	●
41	16.1	2	0.9	1.6	
42	16.5	3	1.4	2.4	
43	16.9	5	1.9	3.3	●
44	17.3	6	2.3	4.2	
45	17.6	7	2.8	5.0	
46	18.0	8	3.3	5.9	
47	18.4	10	3.8	6.8	●
48	18.8	11	4.3	7.6	
49	19.2	12	4.8	8.5	
50	19.6	13	5.3	9.3	
51	20.0	15	5.8	10.2	●
52	20.4	16	6.3	11.1	
53	20.8	17	6.7	11.9	
54	21.2	18	7.2	12.8	
55	21.6	20	7.7	13.7	
56	22.0	21	8.2	14.5	
57	22.4	22	8.7	15.4	

[Drawing 11]

階調設計		元画像		再現	キャリブ・チャート
エンジン階調値	パーセント	画像データ階調値	パーセント	ドット%	
58	22.7	23	9.2	16.3	
59	23.1	25	9.7	17.1	
60	23.5	26	10.2	18.0	
61	23.9	27	10.7	18.8	
62	24.3	28	11.1	19.6	●
63	24.7	30	11.6	20.4	
64	25.1	31	12.1	21.2	
65	25.5	32	12.6	22.0	
66	25.9	33	13.1	22.8	
67	26.3	35	13.6	23.6	
68	26.7	36	14.1	24.4	
69	27.1	37	14.6	25.2	
70	27.5	38	15.1	26.0	
71	27.8	40	15.5	26.7	
72	28.2	41	16.0	27.4	
73	28.6	42	16.5	28.2	
74	29.0	43	17.0	28.9	
75	29.4	45	17.5	29.6	
76	29.8	46	18.0	30.3	
77	30.2	47	18.5	31.1	
78	30.6	48	19.0	31.8	
79	31.0	50	19.5	32.5	
80	31.4	51	19.9	33.2	●
81	31.8	52	20.4	33.9	
82	32.2	53	20.9	34.7	
83	32.5	55	21.4	35.4	
84	32.9	56	21.9	36.1	
85	33.3	57	22.4	36.8	
86	33.7	58	22.9	37.6	
87	34.1	60	23.4	38.3	

[Drawing 12]

階調設計		元画像		再現	キャリブ・チャート
エンジン階調値	パーセント	画像データ階調値	パーセント	ドット%	
88	34.5	61	23.9	39.0	
89	34.9	62	24.3	39.6	
90	35.3	63	24.8	40.2	
91	35.7	65	25.3	40.8	
92	36.1	66	25.8	41.4	
93	36.5	67	26.3	42.0	
94	36.9	68	26.8	42.7	
95	37.3	70	27.3	43.3	
96	37.8	71	27.8	43.9	
97	38.0	72	28.3	44.5	
98	38.4	73	28.7	45.1	
99	38.8	75	29.2	45.7	
100	39.2	76	29.7	46.3	●
101	39.6	77	30.2	46.9	
102	40.0	78	30.7	47.5	
103	40.4	80	31.2	48.1	
104	40.8	81	31.7	48.7	
105	41.2	82	32.2	49.3	
106	41.6	83	32.6	50.0	
107	42.0	85	33.1	50.6	
108	42.4	86	33.6	51.2	
109	42.7	87	34.1	51.8	
110	43.1	88	34.6	52.4	
111	43.5	89	35.1	53.0	
112	43.9	91	35.6	53.6	
113	44.3	92	36.1	54.1	
114	44.7	93	36.6	54.7	
115	45.1	94	37.0	55.2	
116	45.5	96	37.5	55.8	
117	45.9	97	38.0	56.4	

[Drawing 13]

階調設計		元画像		再現	キャリブ・チャート
エンジン階調値	パーセント	画像データ階調値	パーセント	ドット%	
118	46.3	98	38.5	56.9	
119	46.7	99	39.0	57.5	
120	47.1	101	39.5	58.0	●
121	47.5	102	40.0	58.6	
122	47.8	103	40.5	59.2	
123	48.2	104	41.0	59.7	
124	48.6	106	41.4	60.3	
125	49.0	107	41.9	60.8	
126	49.4	108	42.4	61.4	
127	49.8	109	42.9	62.0	
128	50.2	111	43.4	62.5	
129	50.6	112	43.9	63.1	
130	51.0	113	44.4	63.6	
131	51.4	114	44.9	64.2	
132	51.8	116	45.4	64.8	
133	52.2	117	45.8	65.3	
134	52.5	118	46.3	65.9	
135	52.9	119	46.8	66.4	
136	53.3	121	47.3	67.0	
137	53.7	122	47.8	67.4	
138	54.1	123	48.3	67.8	
139	54.5	124	48.8	68.3	
140	54.9	126	49.3	68.7	●
141	55.3	127	49.8	69.1	
142	55.7	128	50.2	69.5	
143	56.1	129	50.7	69.9	
144	56.5	131	51.2	70.3	
145	56.9	132	51.7	70.8	
146	57.3	133	52.2	71.2	
147	57.6	134	52.7	71.6	

[Drawing 17]

階調設計		元画像		再現	キャリブ・チャート	
エンジン階調値	パーセント	画像データ階調値	パーセント	ドット%		
238	93.3	248	97.2	99.2		
239	93.7	249	97.7	99.3	●	
240	94.1	250	98.1	99.5		
241	94.5	252	98.6	99.6		
242	94.9	253	99.1	99.8		
243	95.3	254	99.6	99.9		
244	95.7	255				
245	96.1	255				
246	96.5	255				
247	96.9	255				
248	97.3	255				
249	97.6	255	100.0	100.0	●	{Y M C
250	98.0	255				
251	98.4	255				
252	98.8	255				
253	99.2	255				
254	99.6	255				
255	100.0	255	100.0	100.0		K

[Drawing 14]

階調設計		元画像		再現	キャリブ・チャート
エンジン階調値	パーセント	画像データ階調値	パーセント	ドット%	
148	58.0	136	53.2	72.0	
149	58.4	137	53.7	72.4	
150	58.8	138	54.2	72.8	
151	59.2	139	54.6	73.3	
152	59.6	141	55.1	73.7	
153	60.0	142	55.6	74.1	
154	60.4	143	56.1	74.5	
155	60.8	144	56.6	74.9	
156	61.2	146	57.1	75.3	
157	61.6	147	57.6	75.8	
158	62.0	148	58.1	76.2	
159	62.4	149	58.6	76.6	
160	62.7	151	59.0	77.0	●
161	63.1	152	59.5	77.3	
162	63.5	153	60.0	77.7	
163	63.9	154	60.5	78.0	
164	64.3	156	61.0	78.3	
165	64.7	157	61.5	78.7	
166	65.1	158	62.0	79.0	
167	65.5	159	62.5	79.3	
168	65.9	161	63.0	79.7	
169	66.3	162	63.4	80.0	
170	66.7	163	63.9	80.3	
171	67.1	164	64.4	80.7	
172	67.5	166	64.9	81.0	
173	67.8	167	65.4	81.3	
174	68.2	168	65.9	81.7	
175	68.6	169	66.4	82.0	
176	69.0	170	66.9	82.3	
177	69.4	172	67.4	82.7	

[Drawing 15]

階調設計		元画像		再現	キャリブ・チャート
エンジン階調値	パーセント	画像データ階調値	パーセント	ドット%	
178	69.8	173	67.8	83.0	
179	70.2	174	68.3	83.3	
180	70.6	175	68.8	83.7	
181	71.0	177	69.3	84.0	
182	71.4	178	69.8	84.3	
183	71.8	179	70.3	84.8	
184	72.2	180	70.8	85.0	
185	72.5	182	71.3	85.3	
186	72.9	183	71.7	85.6	
187	73.3	184	72.2	85.9	
188	73.7	185	72.7	86.2	
189	74.1	187	73.2	86.5	
190	74.5	188	73.7	86.9	
191	74.9	189	74.2	87.2	
192	75.3	190	74.7	87.5	
193	75.7	192	75.2	87.8	
194	76.1	193	75.7	88.1	
195	76.5	194	76.1	88.5	
196	76.9	195	76.6	88.8	
197	77.3	197	77.1	89.1	
198	77.6	198	77.6	89.4	
199	78.0	199	78.1	89.7	
200	78.4	200	78.6	90.0	●
201	78.8	202	79.1	90.4	
202	79.2	203	79.6	90.7	
203	79.6	204	80.1	91.0	
204	80.0	205	80.5	91.2	
205	80.4	207	81.0	91.5	
206	80.8	208	81.5	91.7	
207	81.2	209	82.0	92.0	

[Drawing 16]

階調設計		元画像		再現	キャリブ・チャート
エンジン階調値	パーセント	画像データ階調値	パーセント	ドット%	
208	81.6	210	82.5	92.2	
209	82.0	212	83.0	92.4	
210	82.4	213	83.5	92.7	
211	82.7	214	84.0	92.9	
212	83.1	215	84.5	93.1	
213	83.5	217	84.9	93.4	
214	83.9	218	85.4	93.6	
215	84.3	219	85.9	93.9	
216	84.7	220	86.4	94.1	
217	85.1	222	86.9	94.3	
218	85.5	223	87.4	94.6	
219	85.9	224	87.9	94.8	
220	86.3	225	88.4	95.0	●
221	86.7	227	88.9	95.3	
222	87.1	228	89.3	95.5	
223	87.5	229	89.8	95.8	
224	87.8	230	90.3	96.0	
225	88.2	232	90.8	96.3	
226	88.6	233	91.3	96.5	
227	89.0	234	91.8	96.8	
228	89.4	235	92.3	97.0	
229	89.8	237	92.8	97.3	
230	90.2	238	93.3	97.5	
231	90.6	239	93.7	97.8	
232	91.0	240	94.2	98.0	
233	91.4	242	94.7	98.3	
234	91.8	243	95.2	98.5	
235	92.2	244	95.7	98.7	
236	92.5	245	96.2	98.8	
237	92.9	247	96.7	99.0	

[Translation done.]